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Planning Applications Group

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.433	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	200	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.350
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.002	18.274	0.697	26.2	0.086	0.00	0.0		0.350	\/	-1	Pipe/Conduit	
S1.003	113.864	4.339	26.2	0.000	0.00	0.0		0.350	\/	-1	Pipe/Conduit	
S1.004	45.767	0.526	87.0	0.103	0.00	0.0		0.350	\/	-1	Pipe/Conduit	
S1.005	32.280	0.370	87.2	0.000	0.00	0.0		0.350	\/	-1	Pipe/Conduit	
S1.006	21.265	0.244	87.2	0.000	0.00	0.0		0.350	\/	-1	Pipe/Conduit	
S1.007	138.650	1.469	94.4	0.598	0.00	0.0		0.350		-2	Pipe/Conduit	
S1.008	38.569	0.065	593.4	0.793	0.00	0.0	0.600			-3	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.002	36.65	11.78	14.030	0.115	0.0	0.0	0.0	0.56	10644.4	11.4
S1.003	31.62	15.15	13.333	0.115	0.0	0.0	0.0	0.56	10639.5	11.4
S1.004	28.83	17.63	8.994	0.816	0.0	0.0	0.0	0.31	5843.0	74.5
S1.005	27.17	19.37	8.468	0.816	0.0	0.0	0.0	0.31	5835.2	74.5
S1.006	26.20	20.52	8.098	0.816	0.0	0.0	0.0	0.31	5838.2	74.5
S1.007	22.24	26.50	7.854	7.036	0.0	0.0	0.0	0.39	12183.2	593.8
S1.008	21.93	27.08	6.385	7.829	0.0	0.0	0.0	1.09	440.8«	593.8

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Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	18200	2000			4.043	18.940
-2		19000	2000			6.033	31.500
-3		750	650			0.701	0.403

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.002	-	-	100	0.086	0.086	0.086
1.003	-	-	100	0.000	0.000	0.000
1.004	Classification	VERGE/EMBANKMENT	20	0.516	0.103	0.103
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	Classification	RESI MEDIUM DENSITY	60	0.798	0.479	0.479
	Classification	VERGE/EMBANKMENT	20	0.595	0.119	0.598
1.008	Classification	RESI HI DENSITY	80	0.523	0.418	0.418
	Classification	RESI HI DENSITY	80	0.469	0.375	0.793
				Total	Total	Total
				2.986	1.580	1.580

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	SHW94 SOUTHWEST SWALE	8.500	6.320	0.000	10000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	1000	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 558906 173542	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location GB 558906 173542		Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.002	SHW63A NORTHWEST SWALE	15 Winter	2	+0%			
S1.003	SHW63B NORTHWEST SWALE	15 Winter	2	+0%			
S1.004	SHW76 NORTHWEST SWALE	15 Winter	2	+0%			
S1.005	SHW76A NORTHWEST SWALE	15 Winter	2	+0%			
S1.006	SHW77 NORTHWEST SWALE	15 Winter	2	+0%			
S1.007	SHW78 NORTHWEST SWALE	15 Winter	2	+0%			
S1.008	SHW80 NORTHWEST SWALE	30 Winter	2	+0%	30/15 Summer		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.002	SHW63A NORTHWEST SWALE		14.068	-1.962	0.000	0.00	
S1.003	SHW63B NORTHWEST SWALE		13.370	-1.963	0.000	0.00	
S1.004	SHW76 NORTHWEST SWALE		9.278	-1.716	0.000	0.02	
S1.005	SHW76A NORTHWEST SWALE		8.742	-1.726	0.000	0.02	
S1.006	SHW77 NORTHWEST SWALE		8.364	-1.734	0.000	0.02	
S1.007	SHW78 NORTHWEST SWALE		8.240	-1.614	0.000	0.06	
S1.008	SHW80 NORTHWEST SWALE		6.988	-0.047	0.000	1.05	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	SHW63A NORTHWEST SWALE		16.0	OK	
S1.003	SHW63B NORTHWEST SWALE		14.2	OK	
S1.004	SHW76 NORTHWEST SWALE		102.0	OK	
S1.005	SHW76A NORTHWEST SWALE		95.1	OK	
S1.006	SHW77 NORTHWEST SWALE		90.1	OK	
S1.007	SHW78 NORTHWEST SWALE		675.9	OK	
S1.008	SHW80 NORTHWEST SWALE		464.6	OK*	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location GB 558906 173542		Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.002	SHW63A NORTHWEST SWALE 15	Winter	30	+0%			
S1.003	SHW63B NORTHWEST SWALE 15	Winter	30	+0%			
S1.004	SHW76 NORTHWEST SWALE 15	Winter	30	+0%			
S1.005	SHW76A NORTHWEST SWALE 15	Winter	30	+0%			
S1.006	SHW77 NORTHWEST SWALE 15	Winter	30	+0%			
S1.007	SHW78 NORTHWEST SWALE 15	Winter	30	+0%			
S1.008	SHW80 NORTHWEST SWALE 30	Winter	30	+0%	30/15 Summer		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.002	SHW63A NORTHWEST SWALE		14.142	-1.888	0.000	0.00	
S1.003	SHW63B NORTHWEST SWALE		13.443	-1.890	0.000	0.00	
S1.004	SHW76 NORTHWEST SWALE		9.436	-1.558	0.000	0.04	
S1.005	SHW76A NORTHWEST SWALE		8.880	-1.588	0.000	0.04	
S1.006	SHW77 NORTHWEST SWALE		8.515	-1.583	0.000	0.04	
S1.007	SHW78 NORTHWEST SWALE		8.455	-1.399	0.000	0.11	
S1.008	SHW80 NORTHWEST SWALE		7.436	0.401	0.000	2.29	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	SHW63A NORTHWEST SWALE		46.5	OK	
S1.003	SHW63B NORTHWEST SWALE		38.2	OK	
S1.004	SHW76 NORTHWEST SWALE		225.3	OK	
S1.005	SHW76A NORTHWEST SWALE		204.5	OK	
S1.006	SHW77 NORTHWEST SWALE		206.4	OK	
S1.007	SHW78 NORTHWEST SWALE		1399.6	OK	
S1.008	SHW80 NORTHWEST SWALE		1007.8	SURCHARGED*	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location GB 558906 173542		Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.002	SHW63A NORTHWEST SWALE	15 Winter	100	+20%			
S1.003	SHW63B NORTHWEST SWALE	15 Winter	100	+20%			
S1.004	SHW76 NORTHWEST SWALE	15 Winter	100	+20%			
S1.005	SHW76A NORTHWEST SWALE	15 Winter	100	+20%			
S1.006	SHW77 NORTHWEST SWALE	30 Winter	100	+20%			
S1.007	SHW78 NORTHWEST SWALE	30 Winter	100	+20%			
S1.008	SHW80 NORTHWEST SWALE	60 Winter	100	+20%	30/15 Summer		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.002	SHW63A NORTHWEST SWALE		14.206	-1.824	0.000	0.01	
S1.003	SHW63B NORTHWEST SWALE		13.505	-1.828	0.000	0.01	
S1.004	SHW76 NORTHWEST SWALE		9.558	-1.436	0.000	0.06	
S1.005	SHW76A NORTHWEST SWALE		8.987	-1.481	0.000	0.05	
S1.006	SHW77 NORTHWEST SWALE		8.626	-1.472	0.000	0.05	
S1.007	SHW78 NORTHWEST SWALE		8.574	-1.280	0.000	0.17	
S1.008	SHW80 NORTHWEST SWALE		7.769	0.734	0.000	2.95	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	SHW63A NORTHWEST SWALE		73.2	OK	
S1.003	SHW63B NORTHWEST SWALE		59.3	OK	
S1.004	SHW76 NORTHWEST SWALE		334.0	OK	
S1.005	SHW76A NORTHWEST SWALE		297.7	OK	
S1.006	SHW77 NORTHWEST SWALE		298.5	OK	
S1.007	SHW78 NORTHWEST SWALE		2012.5	OK	
S1.008	SHW80 NORTHWEST SWALE		1300.8	SURCHARGED*	

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